

FIG. 1



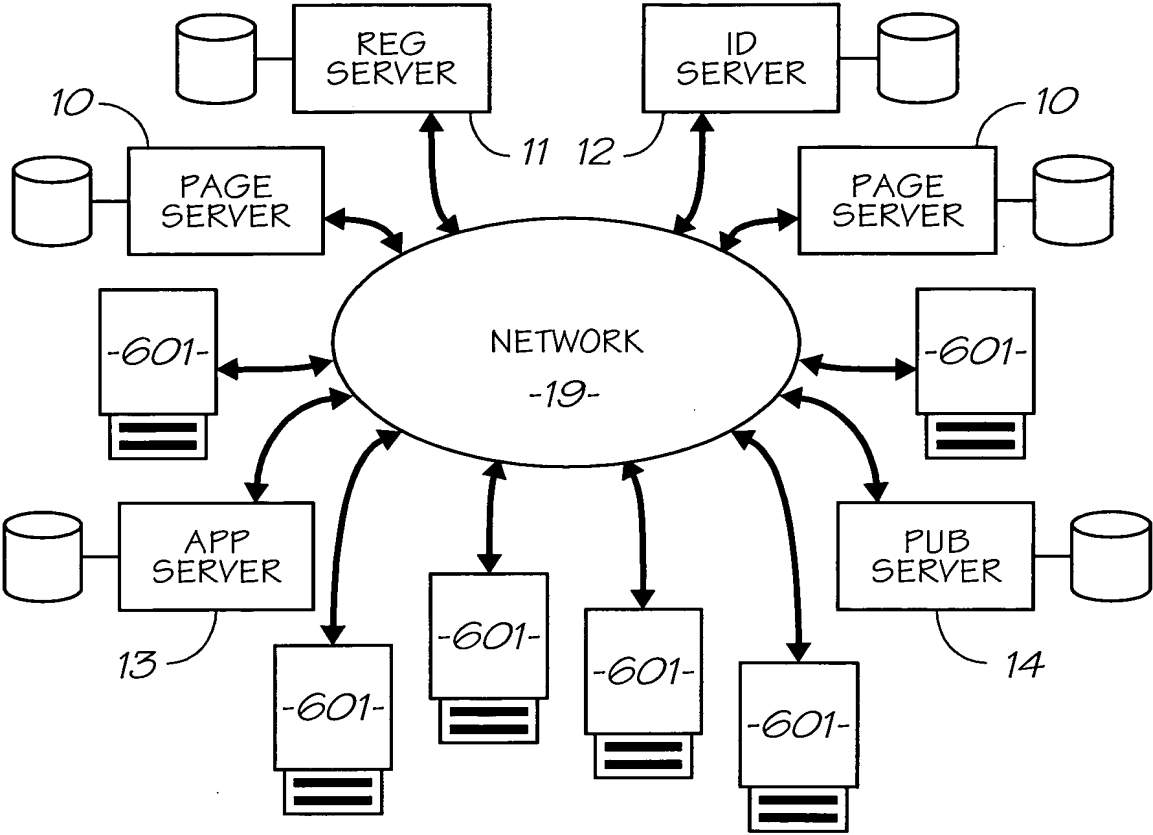


FIG. 3

0954501 5254560



[illegible]

0000096748





FIG. 8





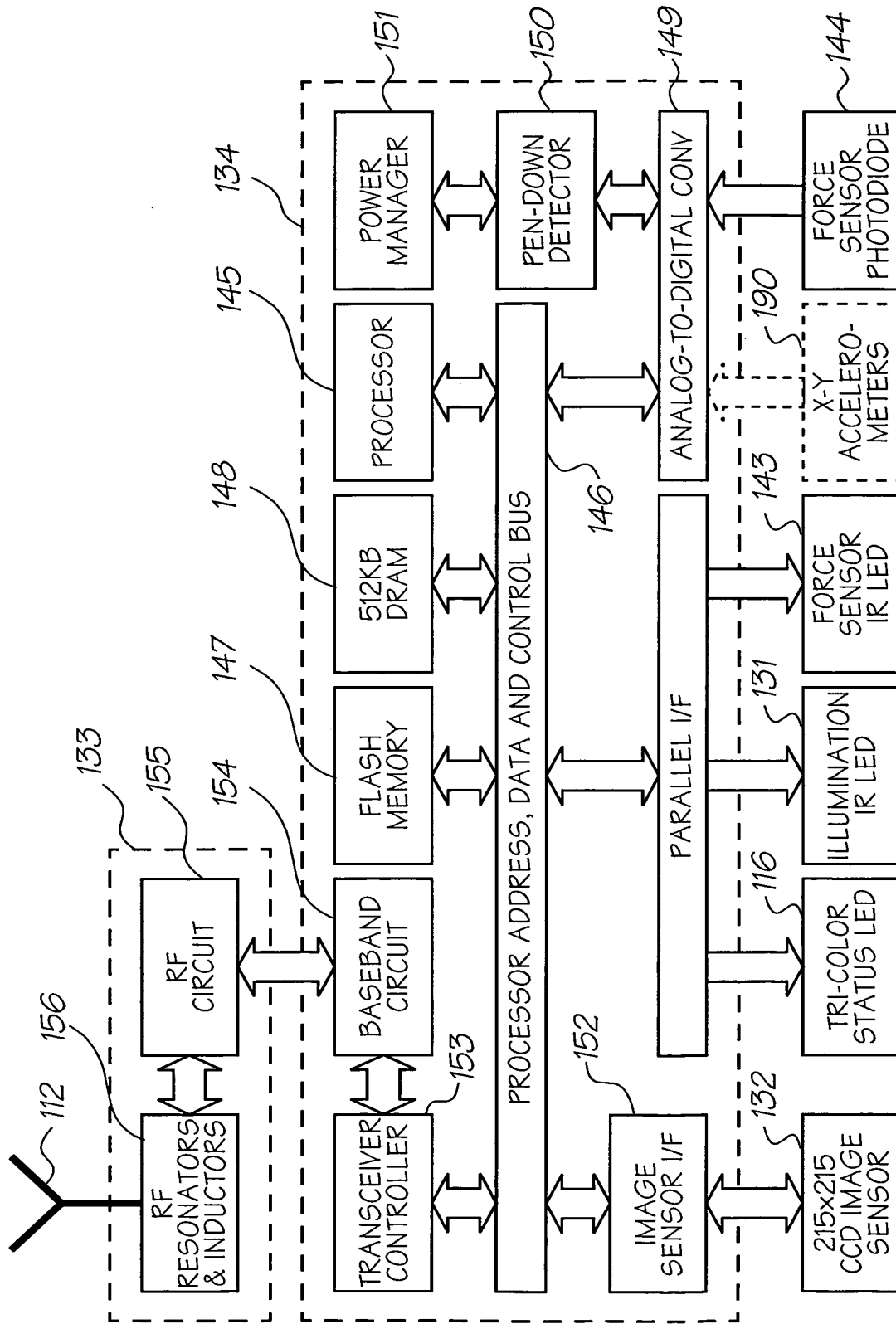


FIG. 10

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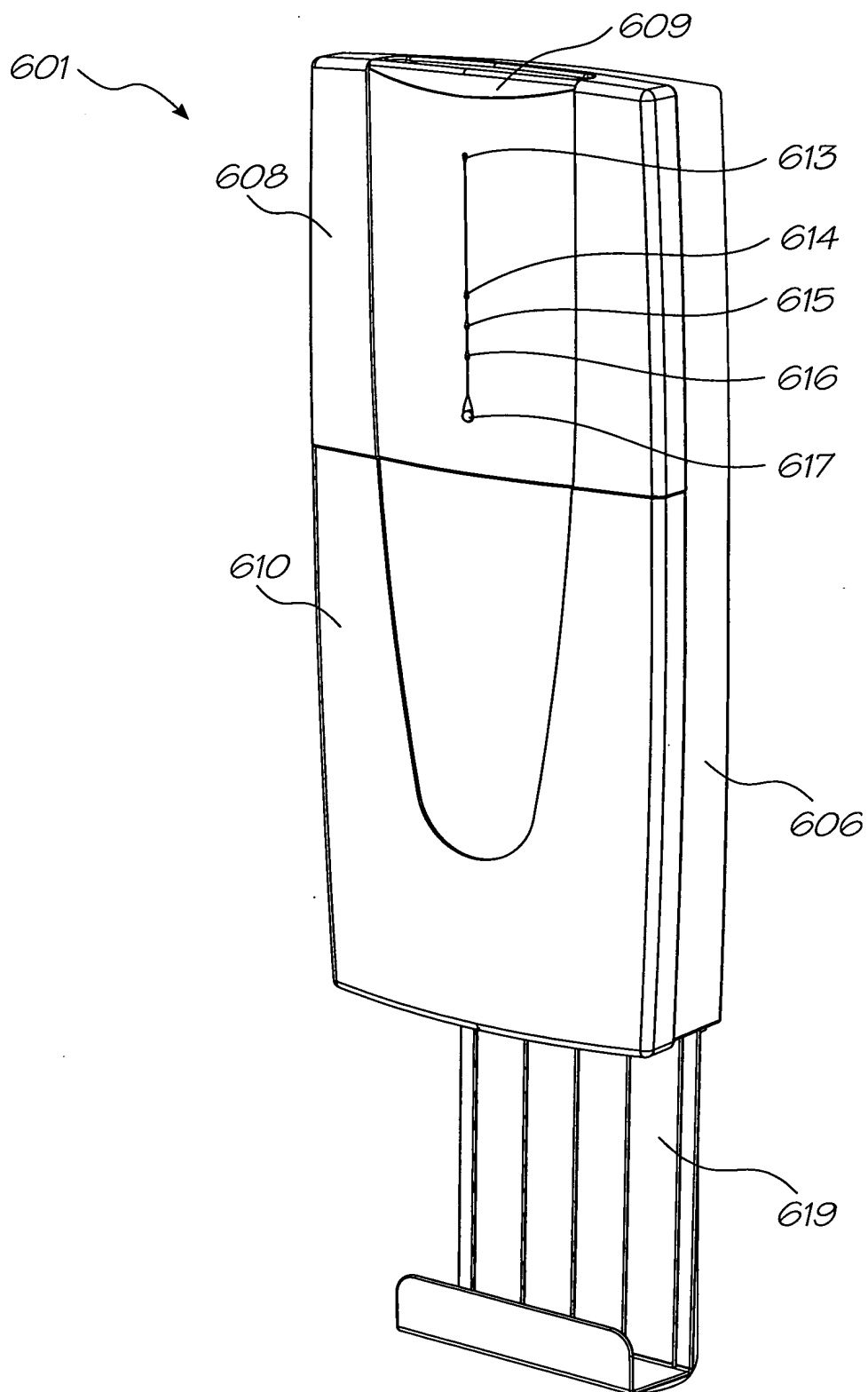


FIG. 11

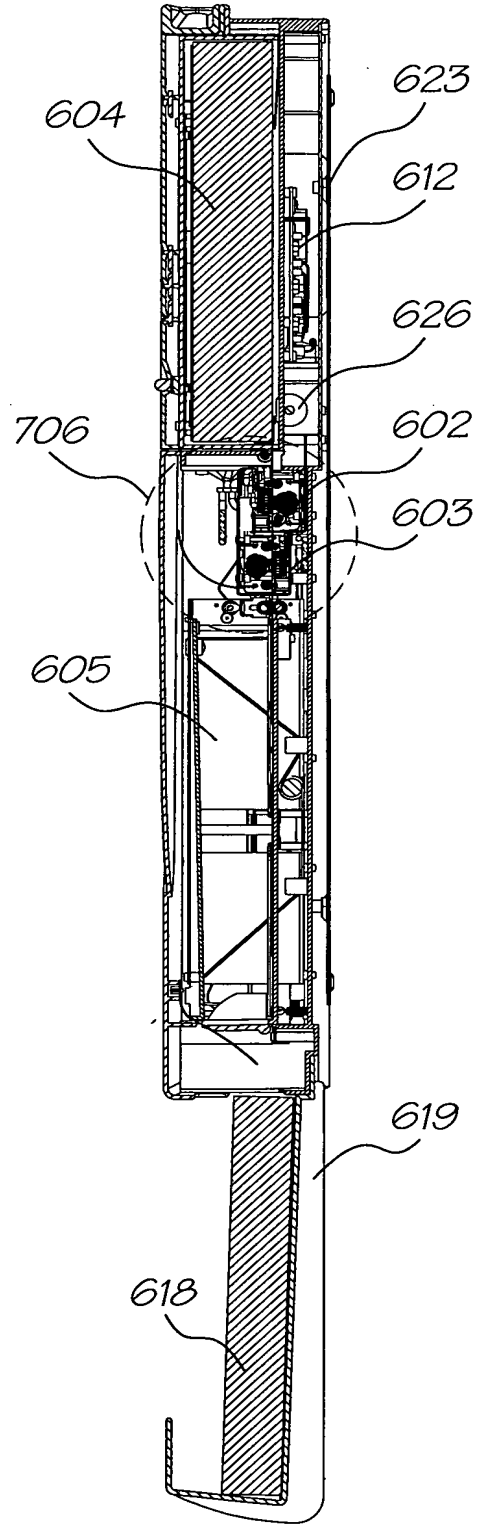


FIG. 12

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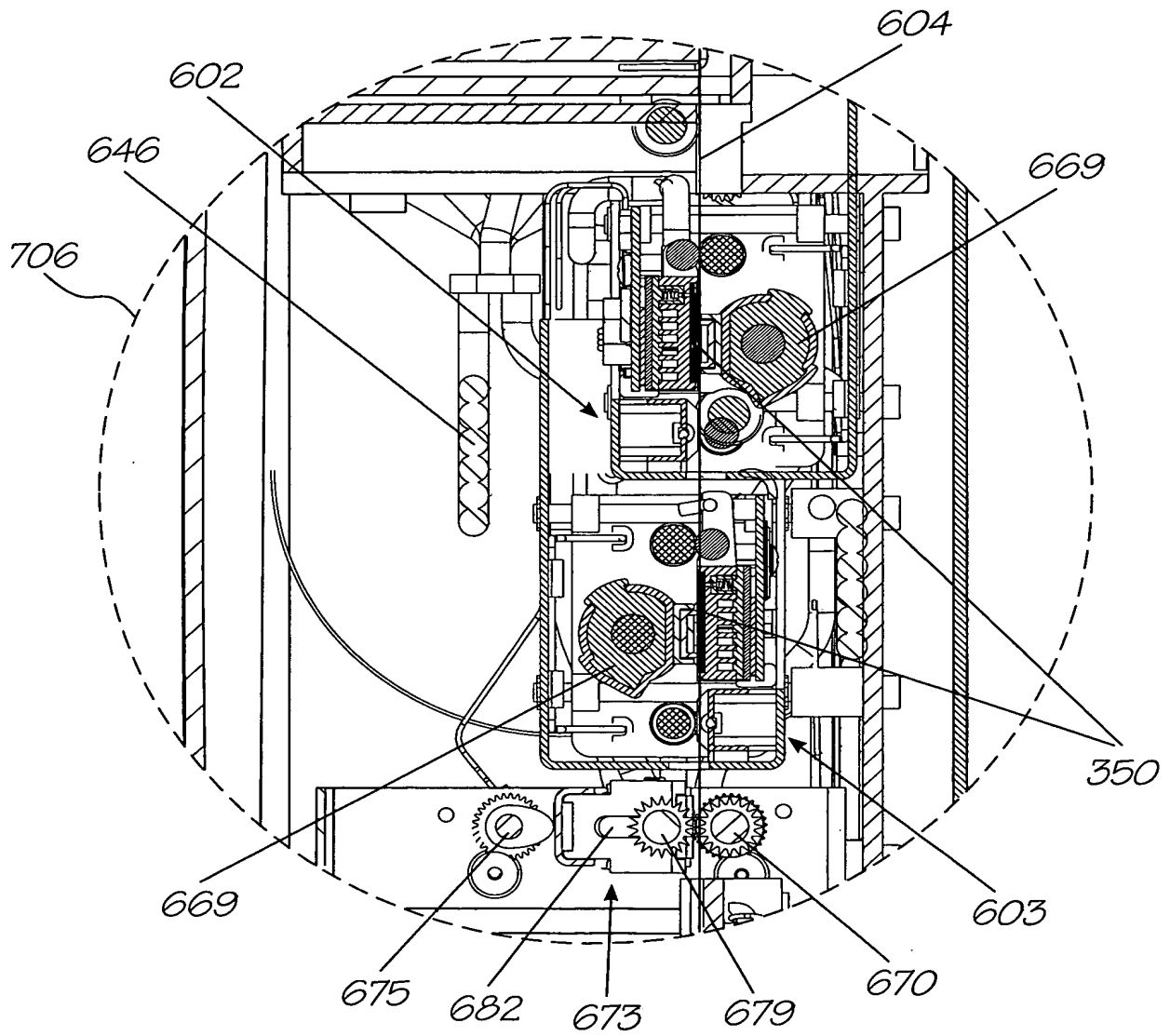


FIG. 12a



FIG. 13

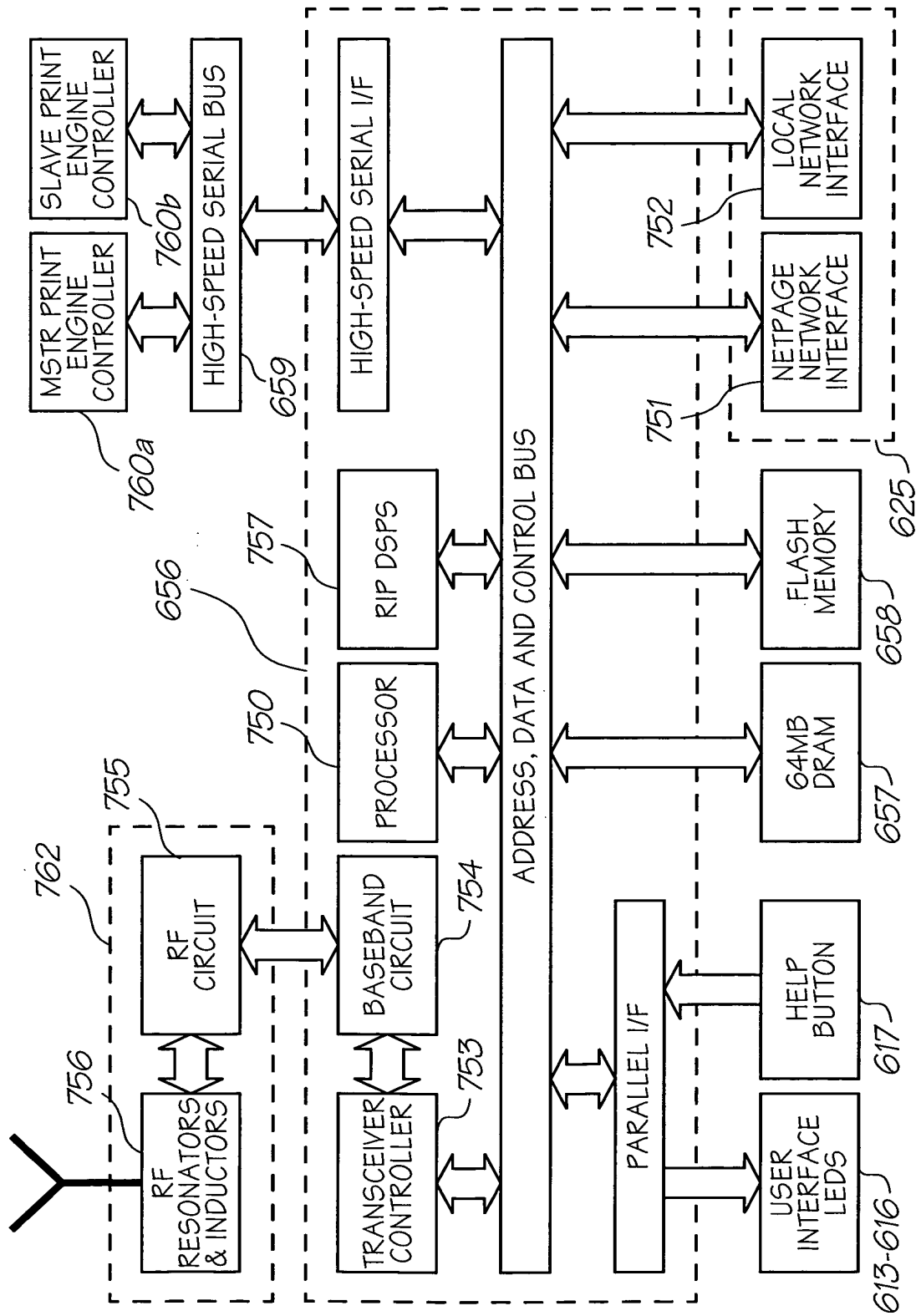


FIG. 14

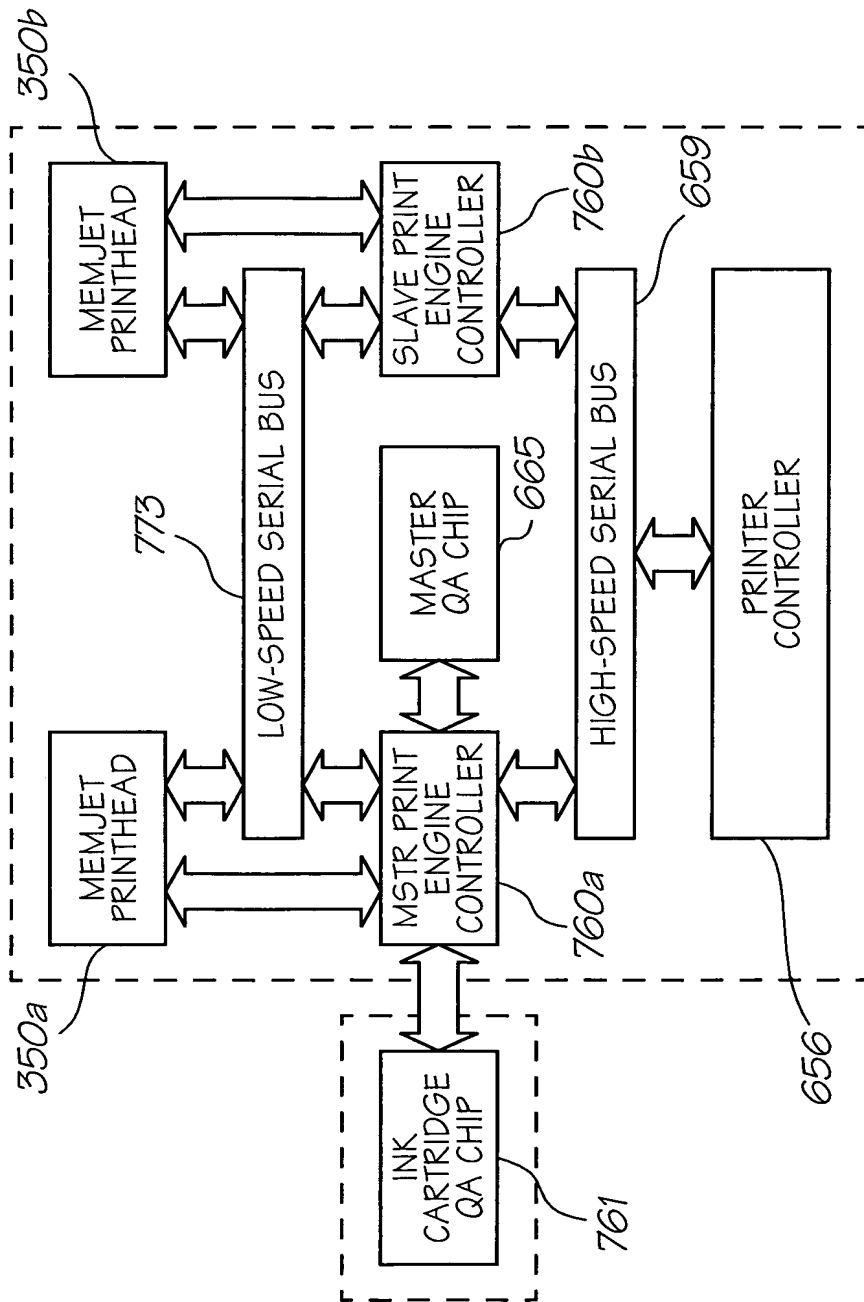


FIG. 15

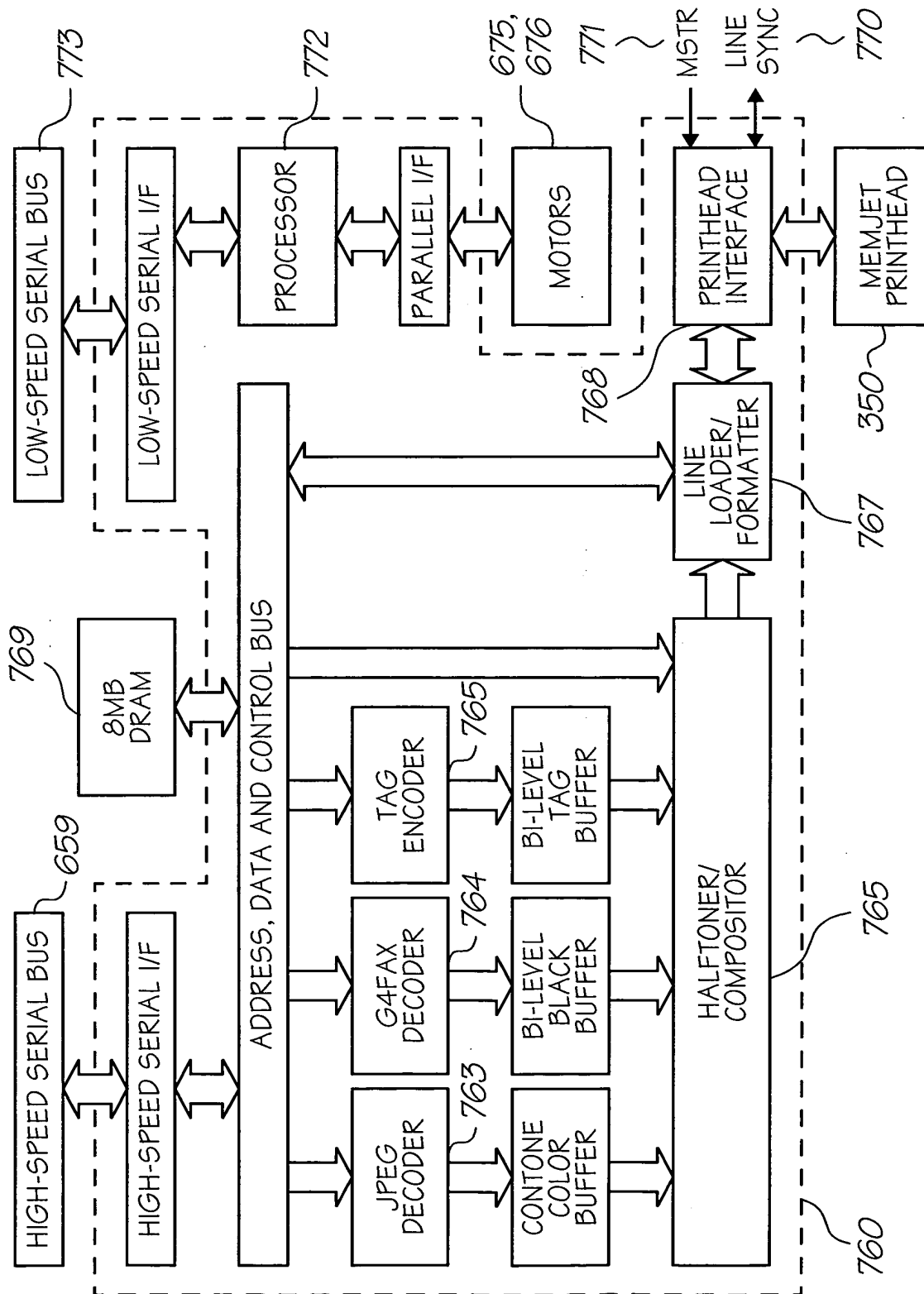


FIG. 16





FIG. 17

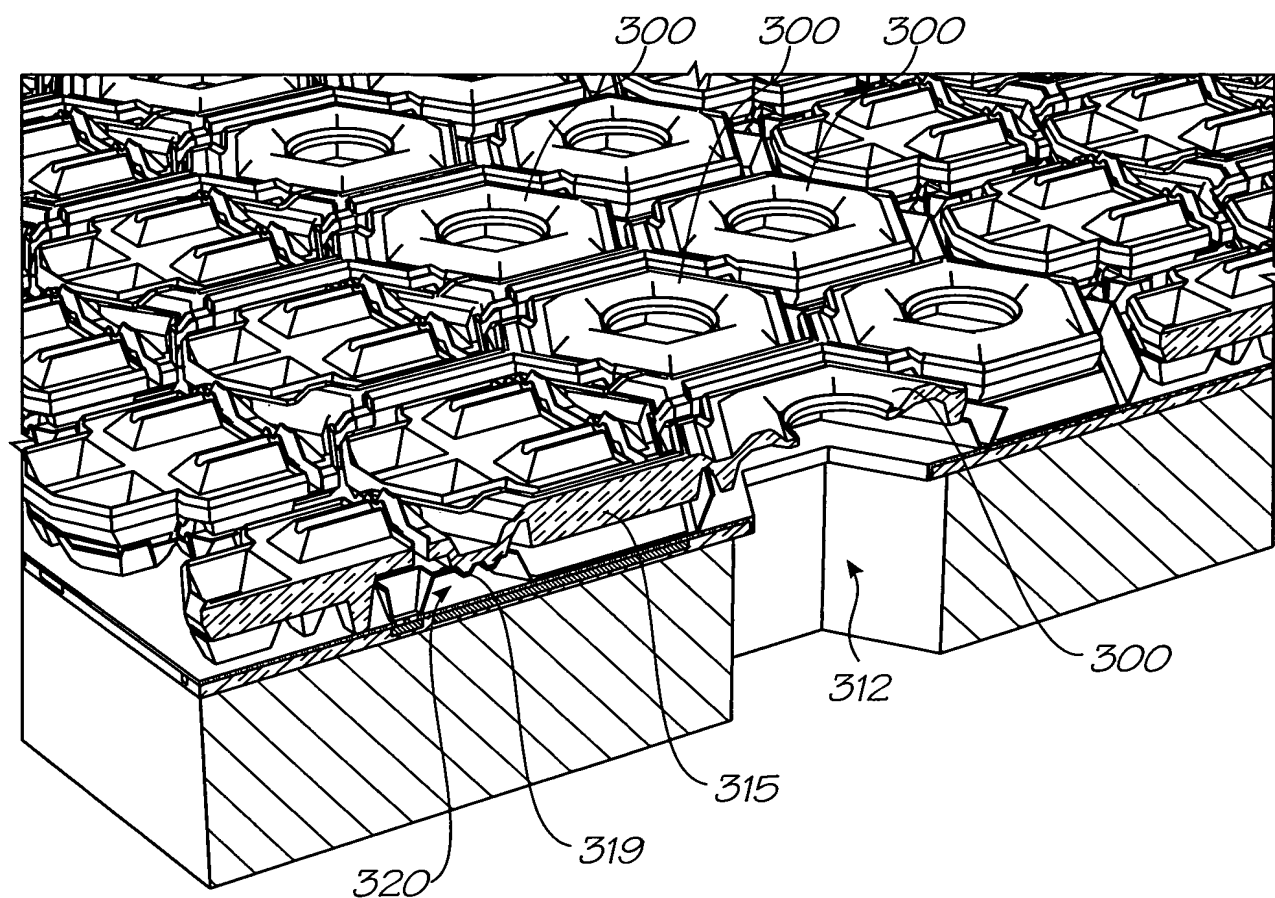


FIG. 18

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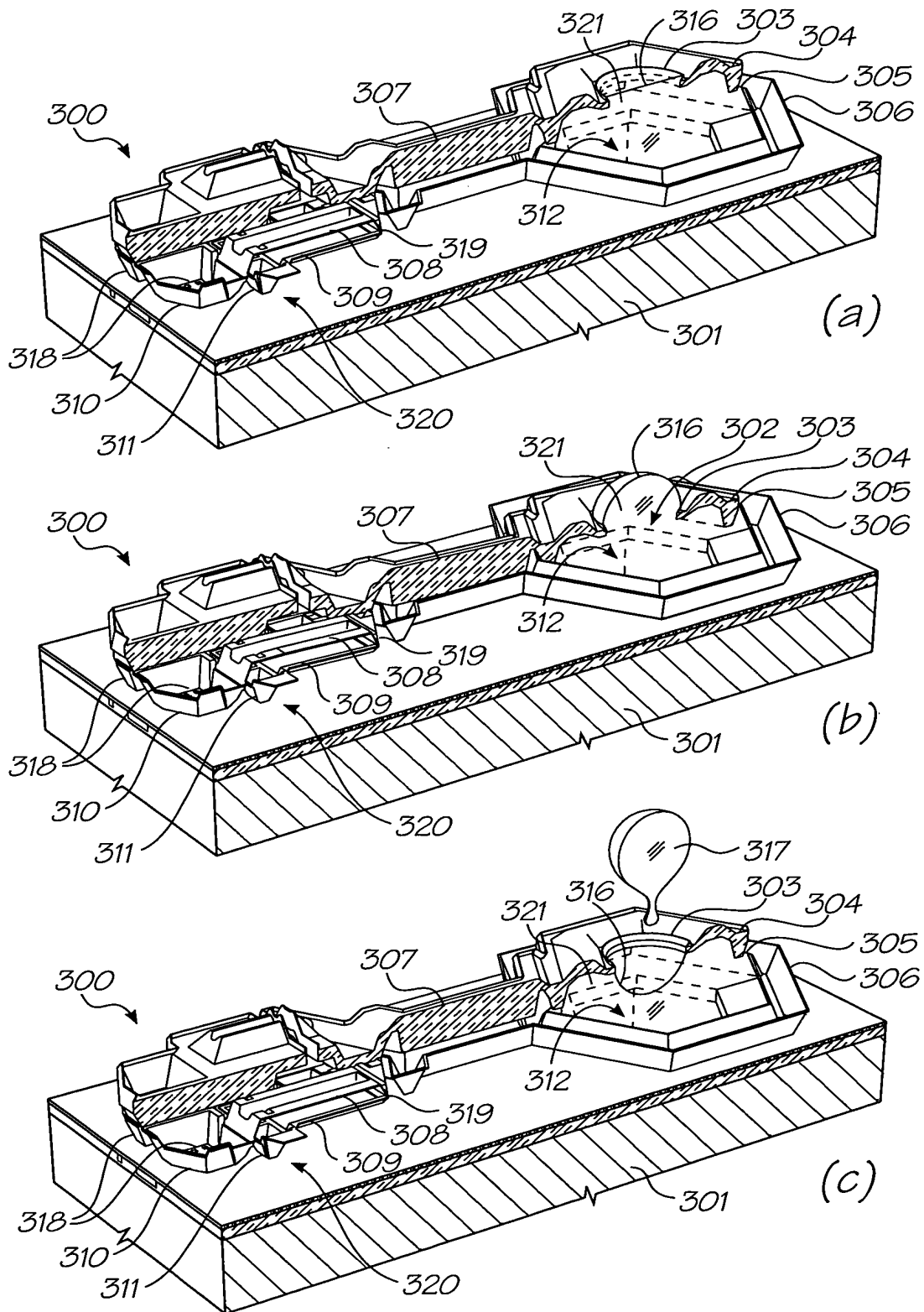


FIG. 19

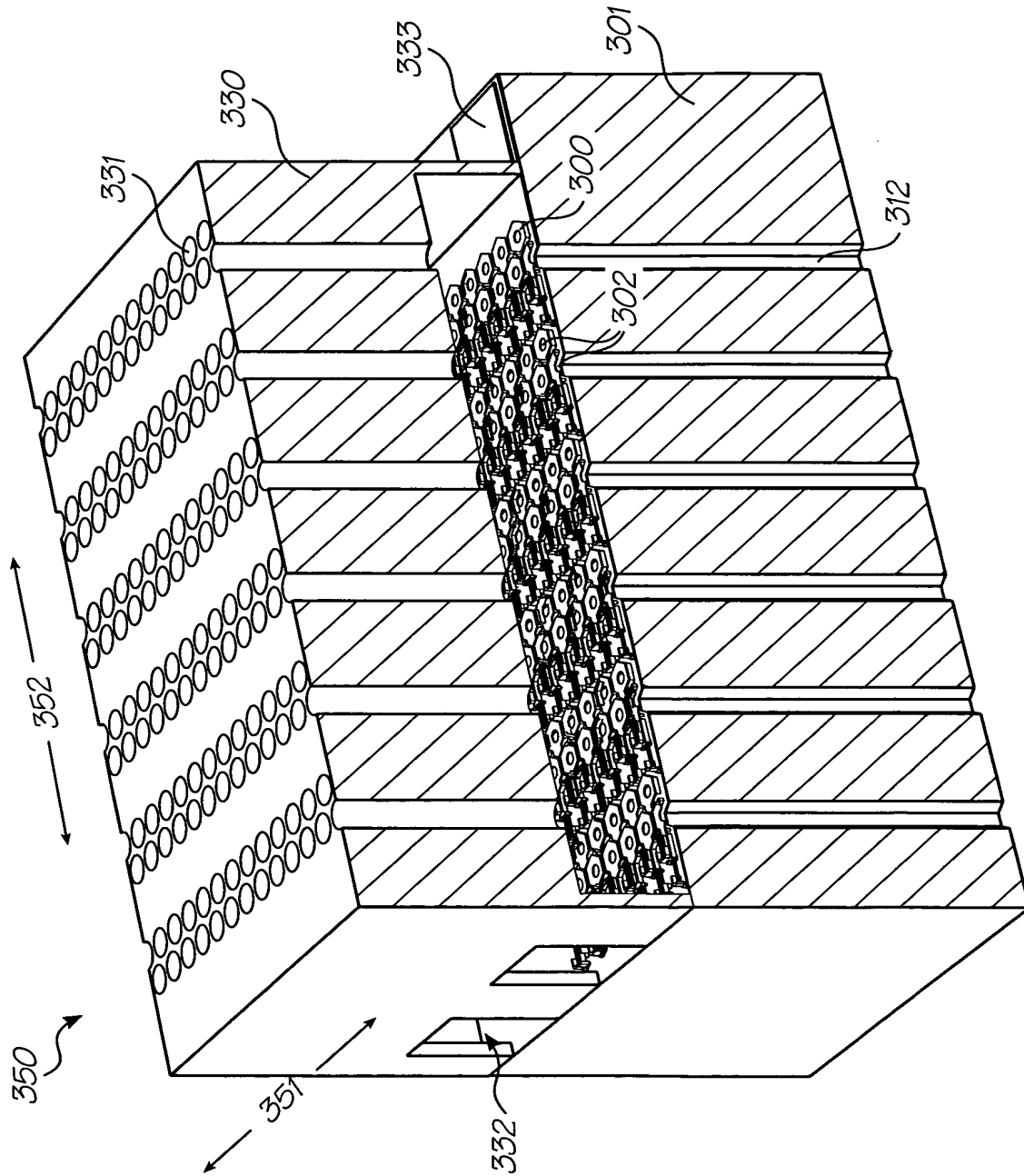


FIG. 20







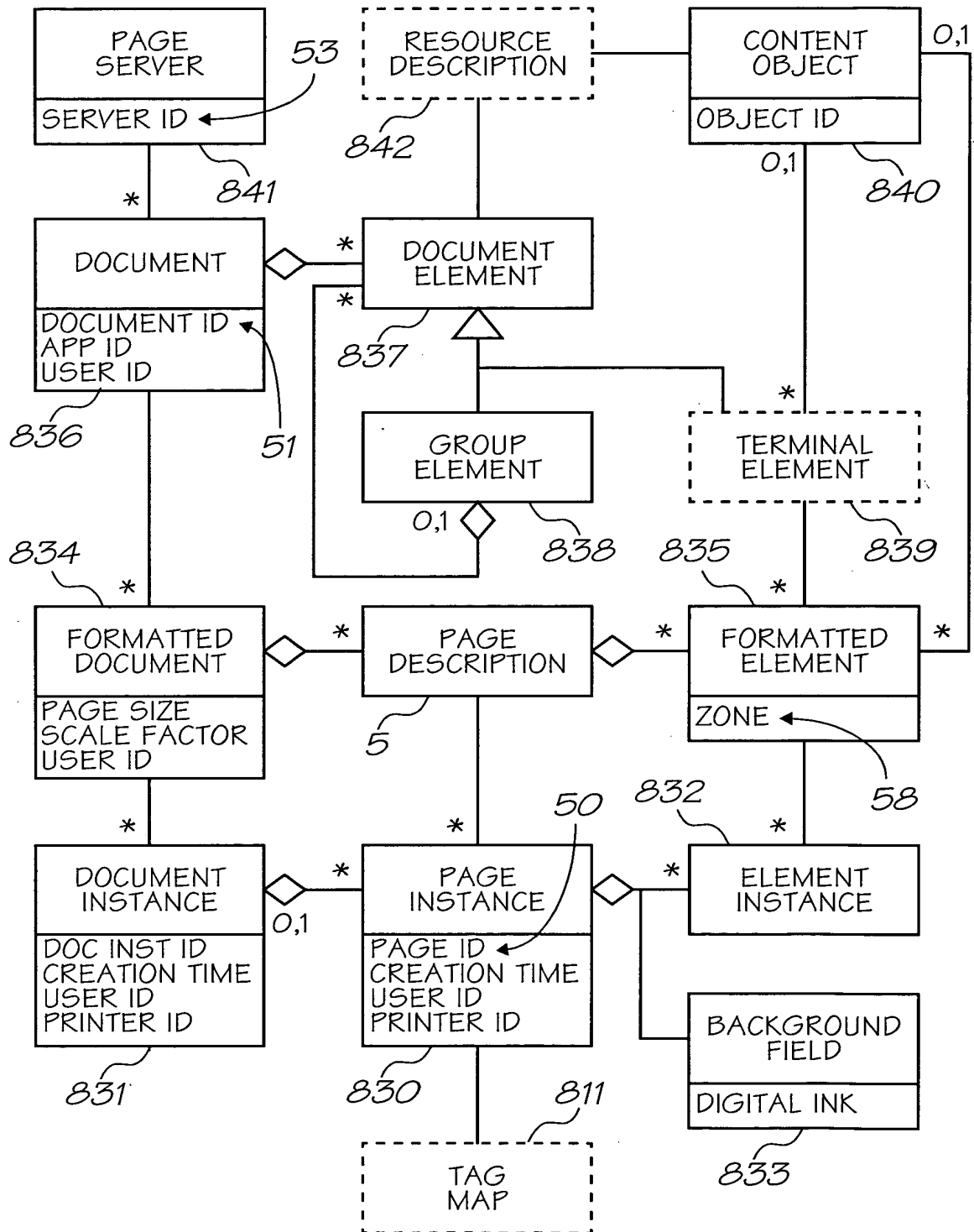


FIG. 25





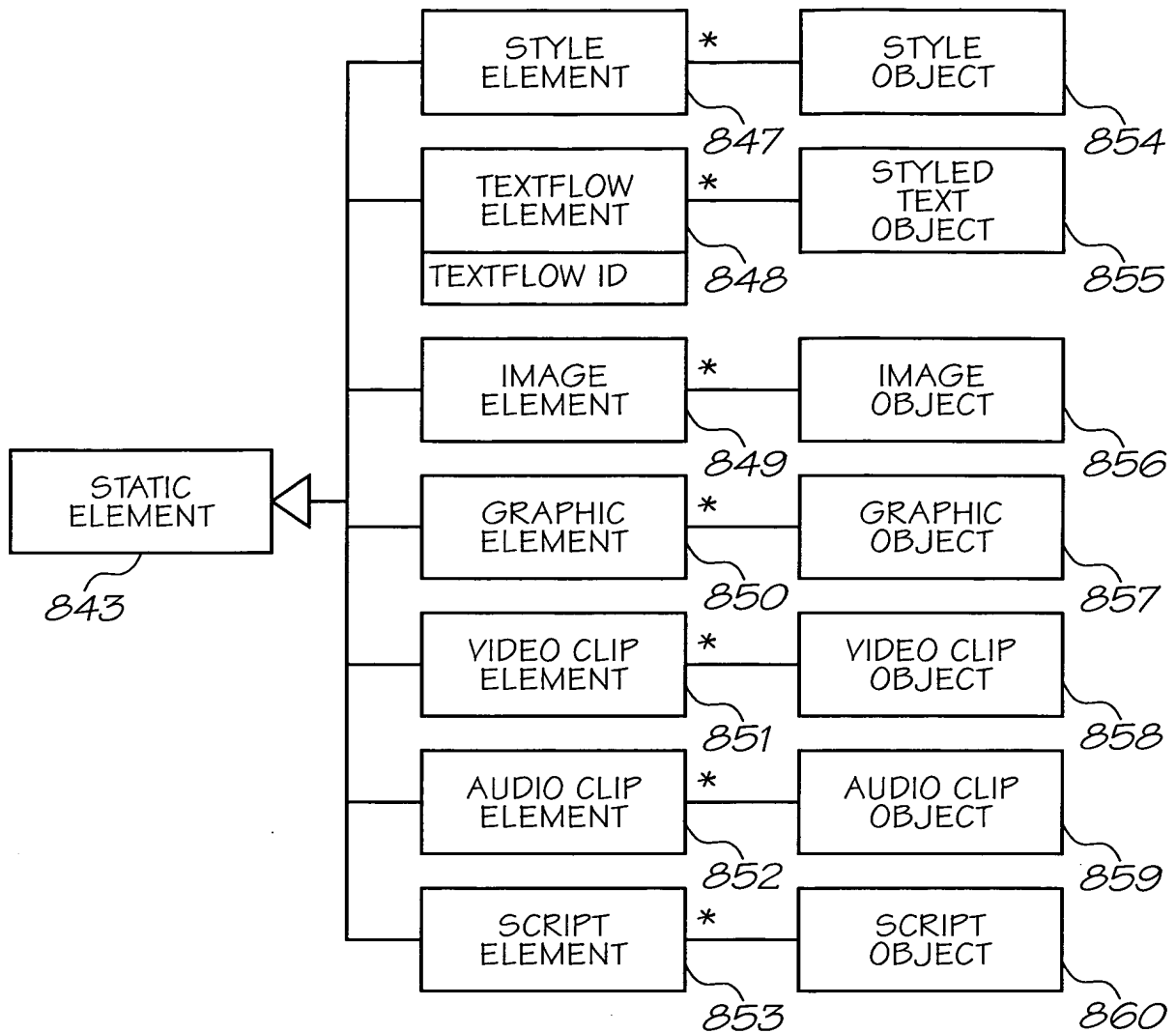


FIG. 28







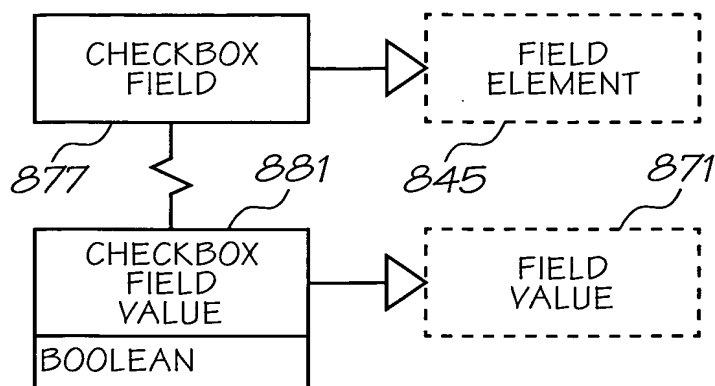


FIG. 35

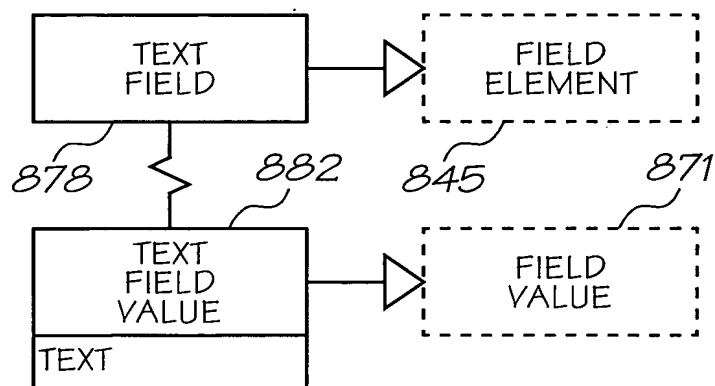


FIG. 36

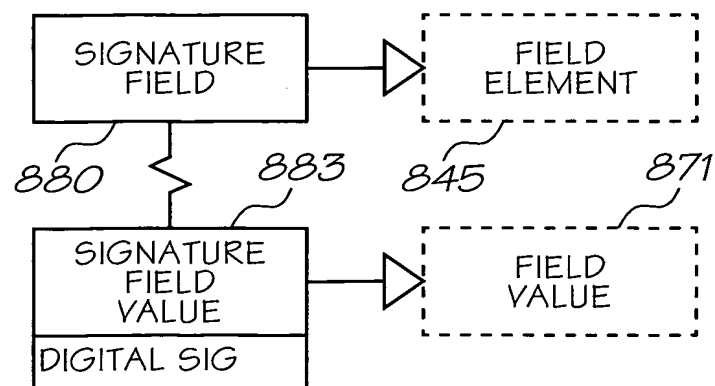


FIG. 37

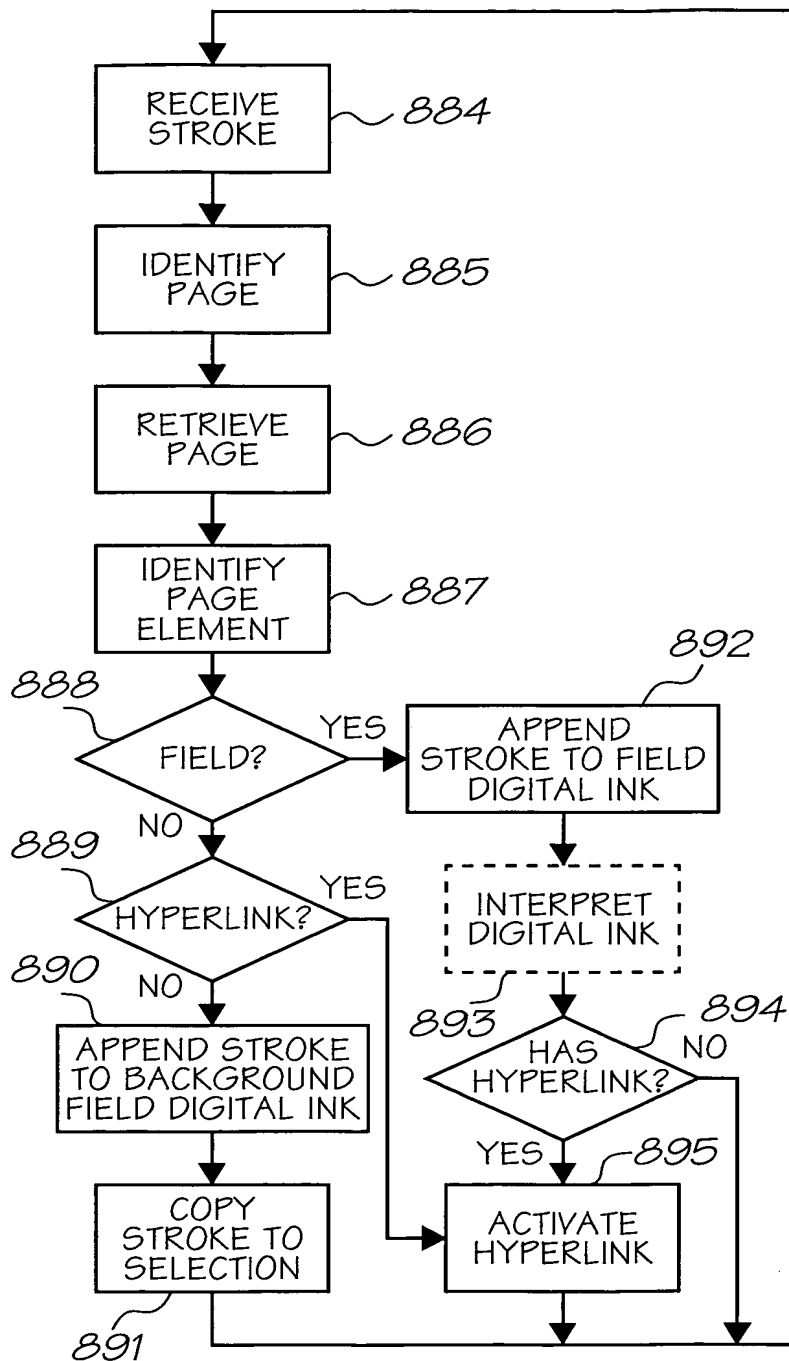


FIG. 38





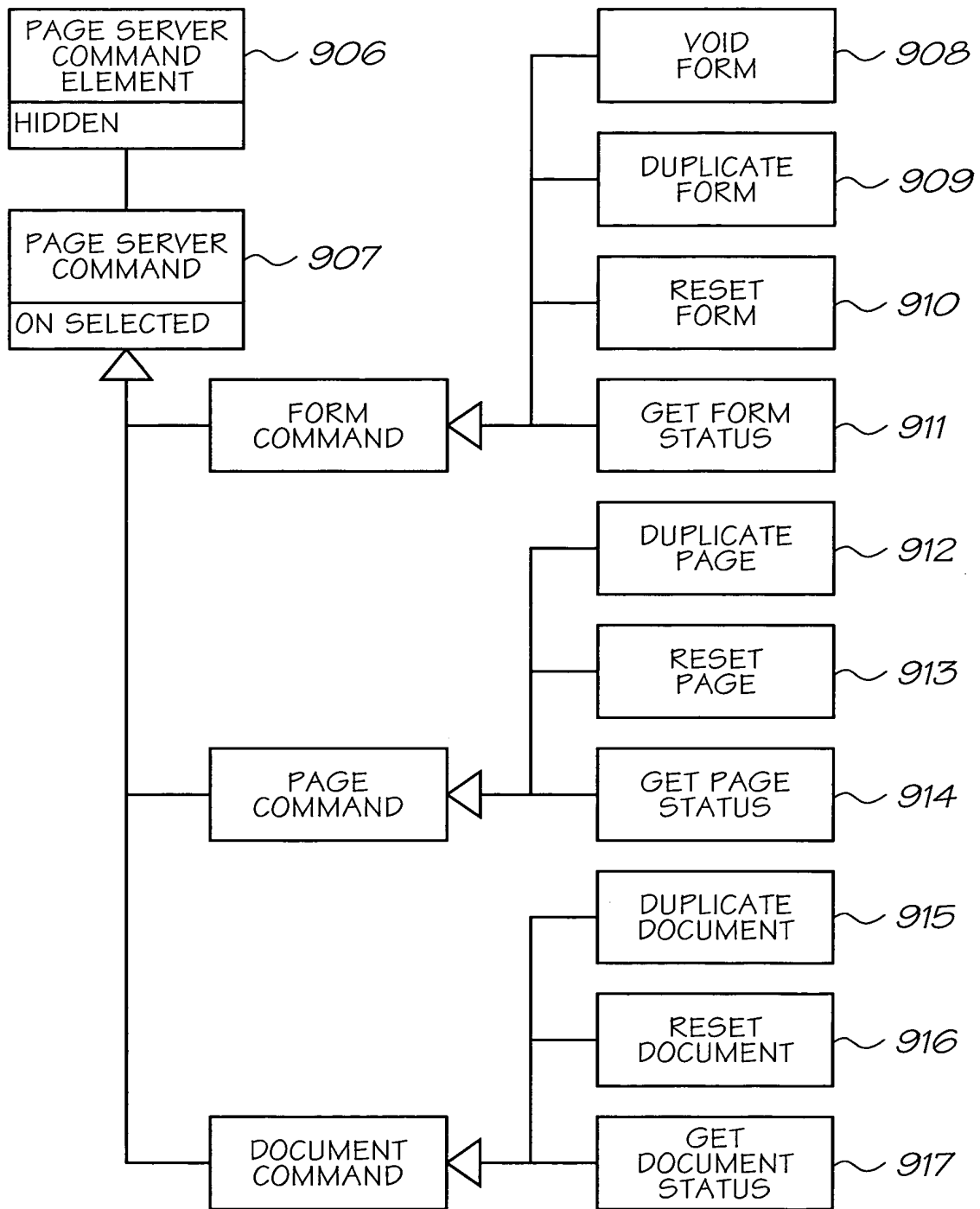


FIG. 39

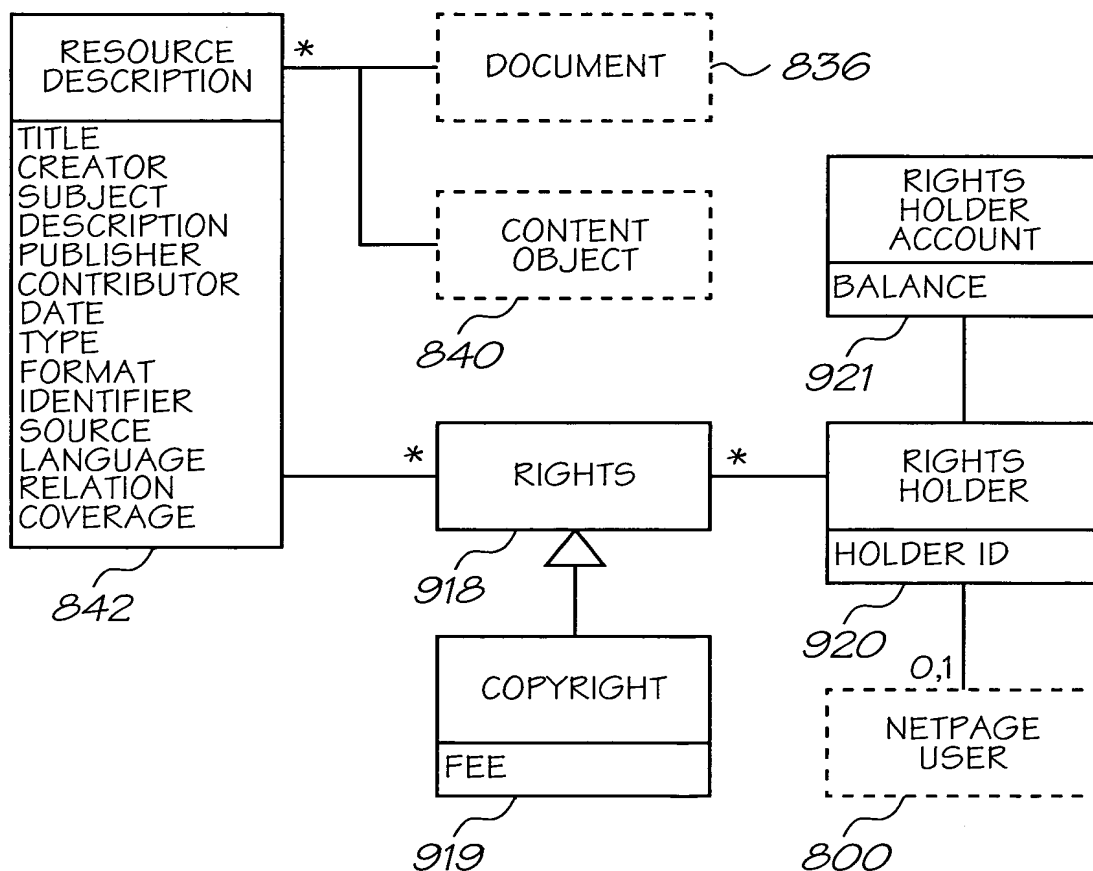


FIG. 40

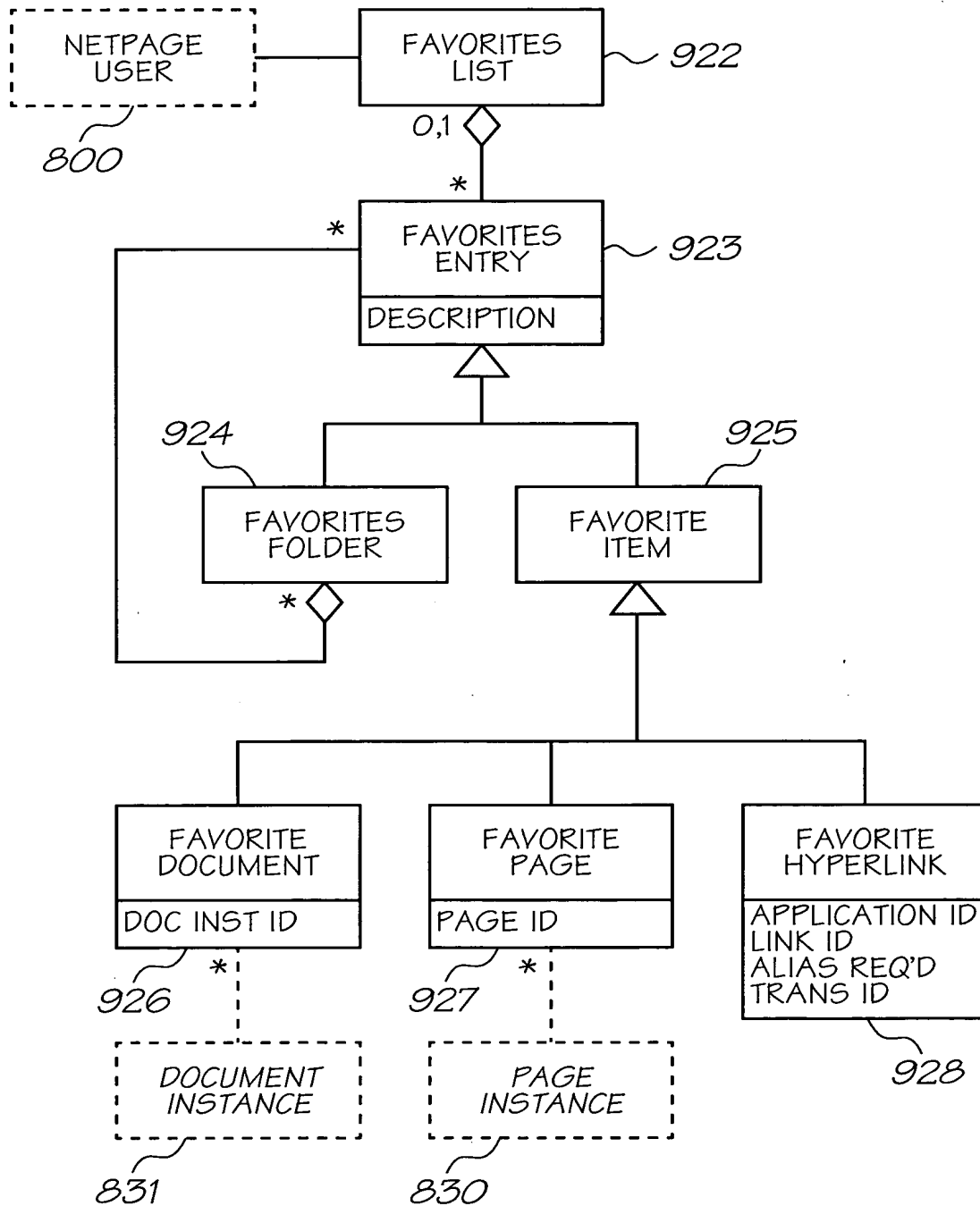


FIG. 41

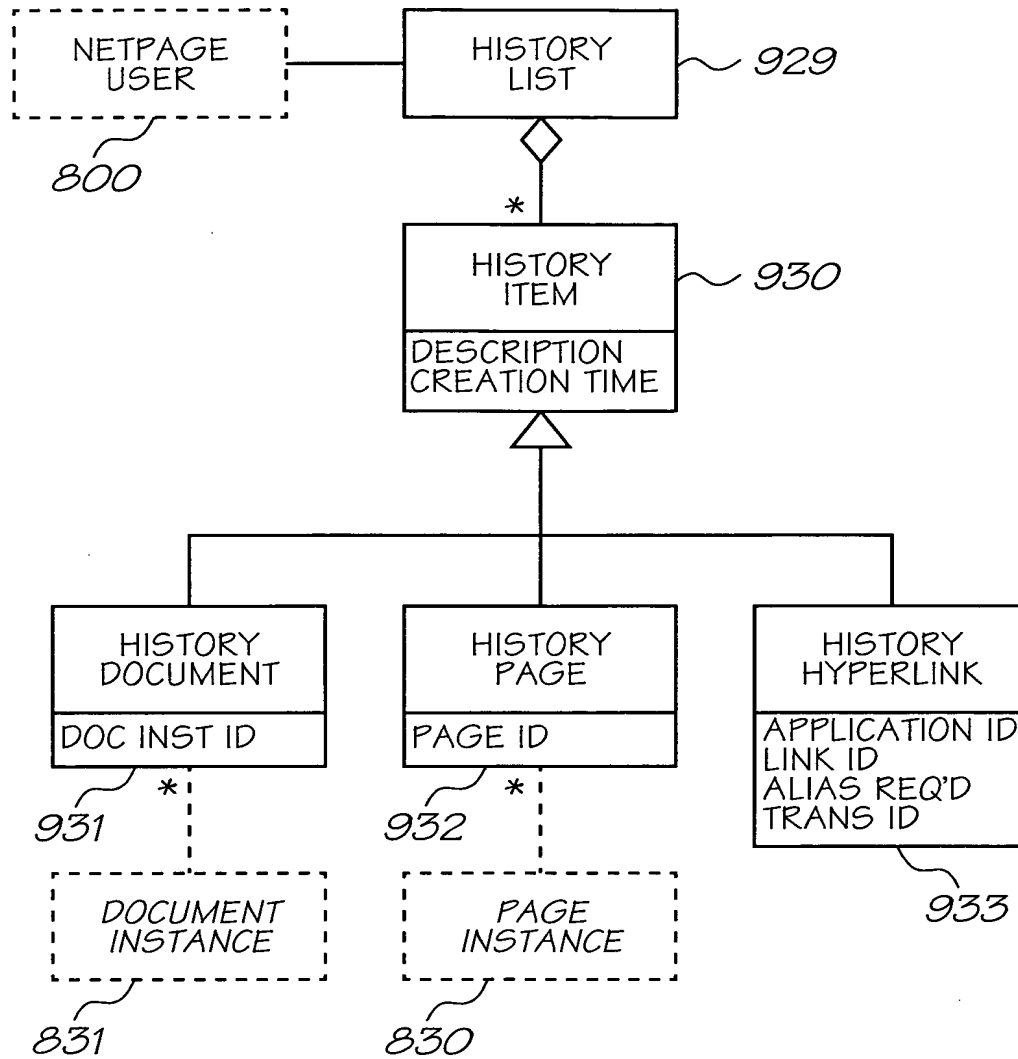


FIG. 42

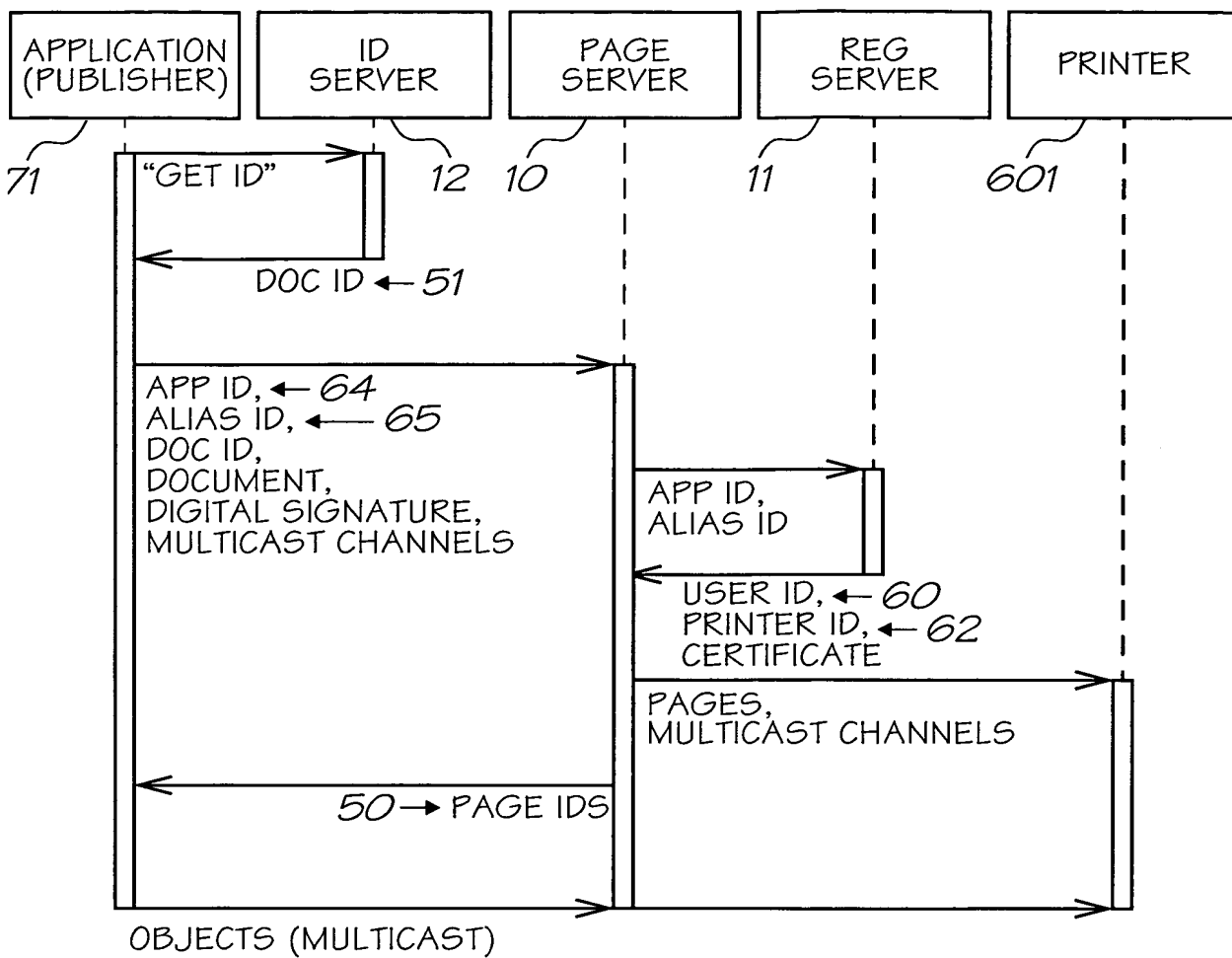


FIG. 43

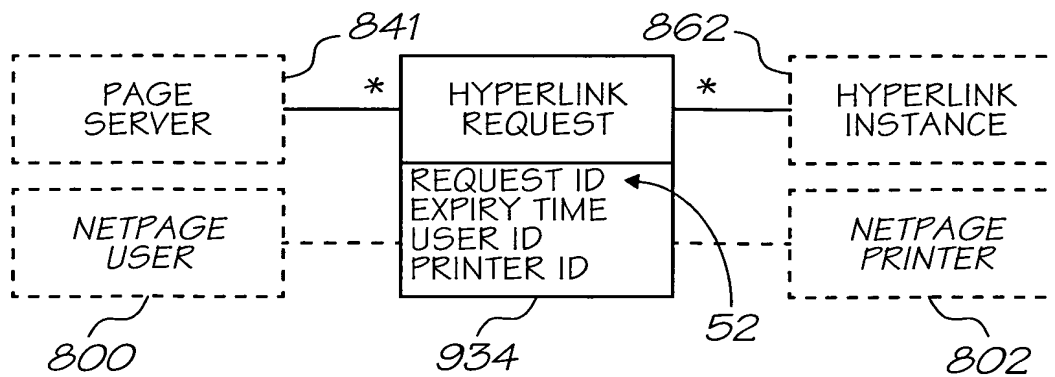


FIG. 44

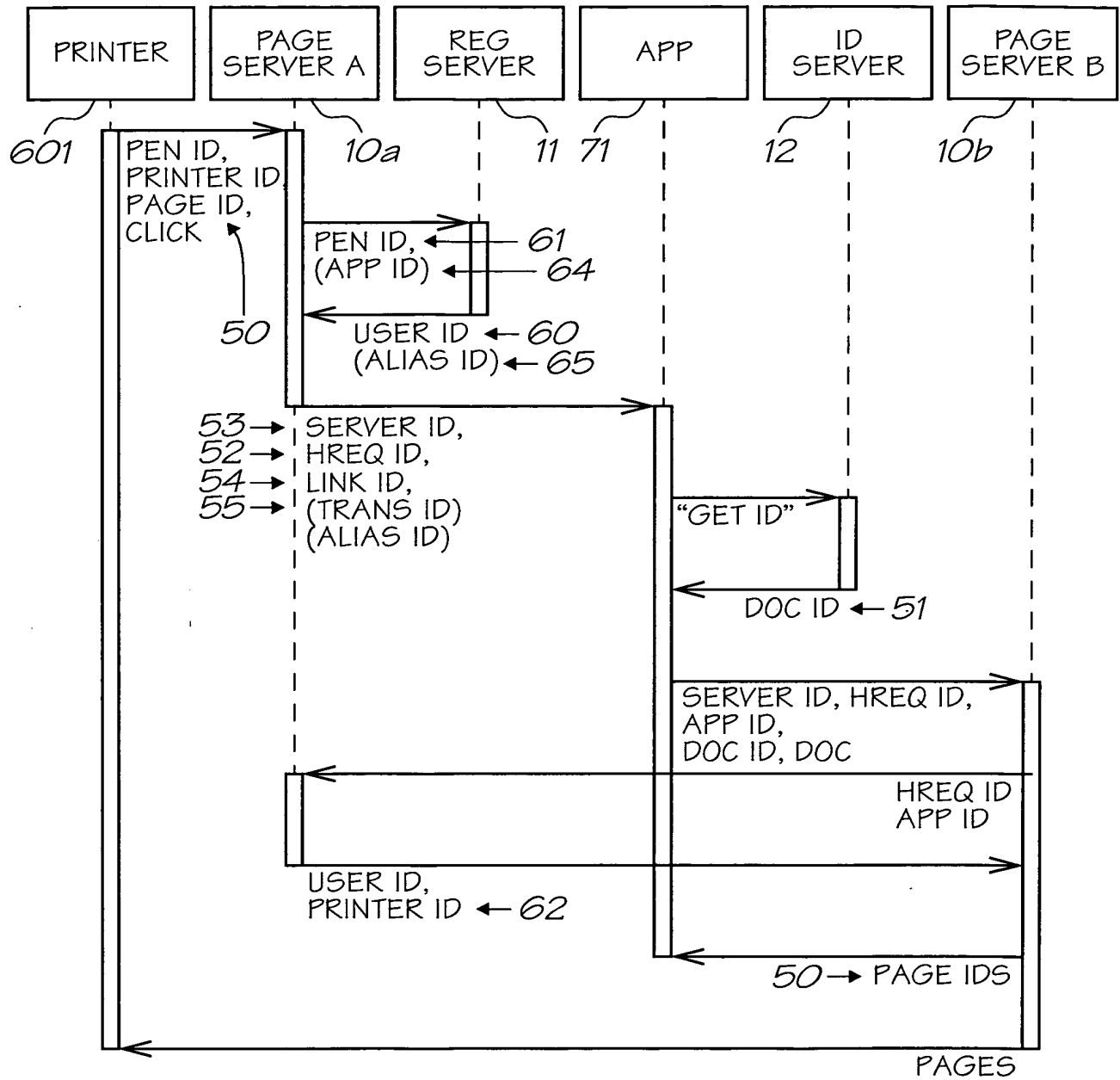


FIG. 45

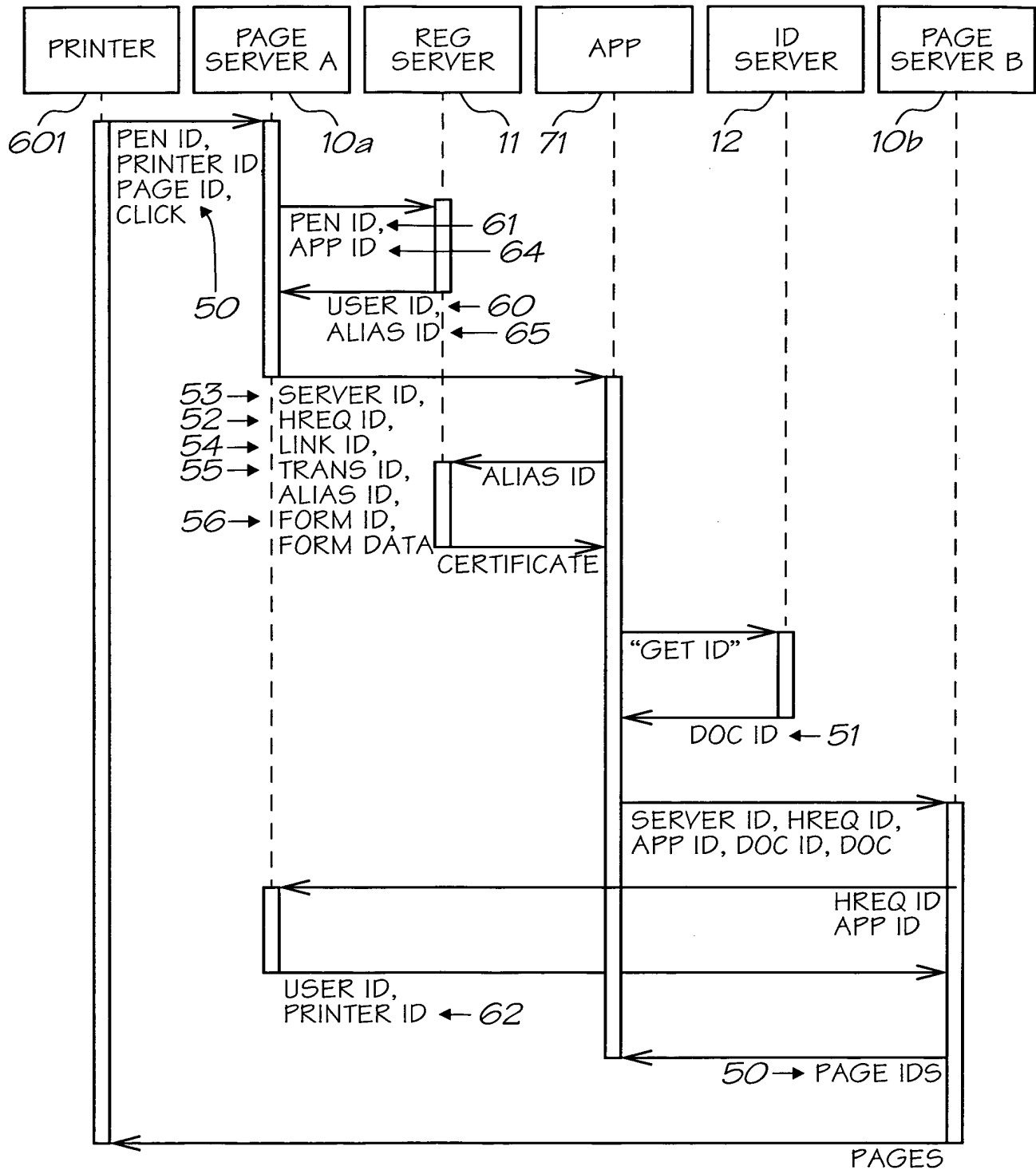


FIG. 46

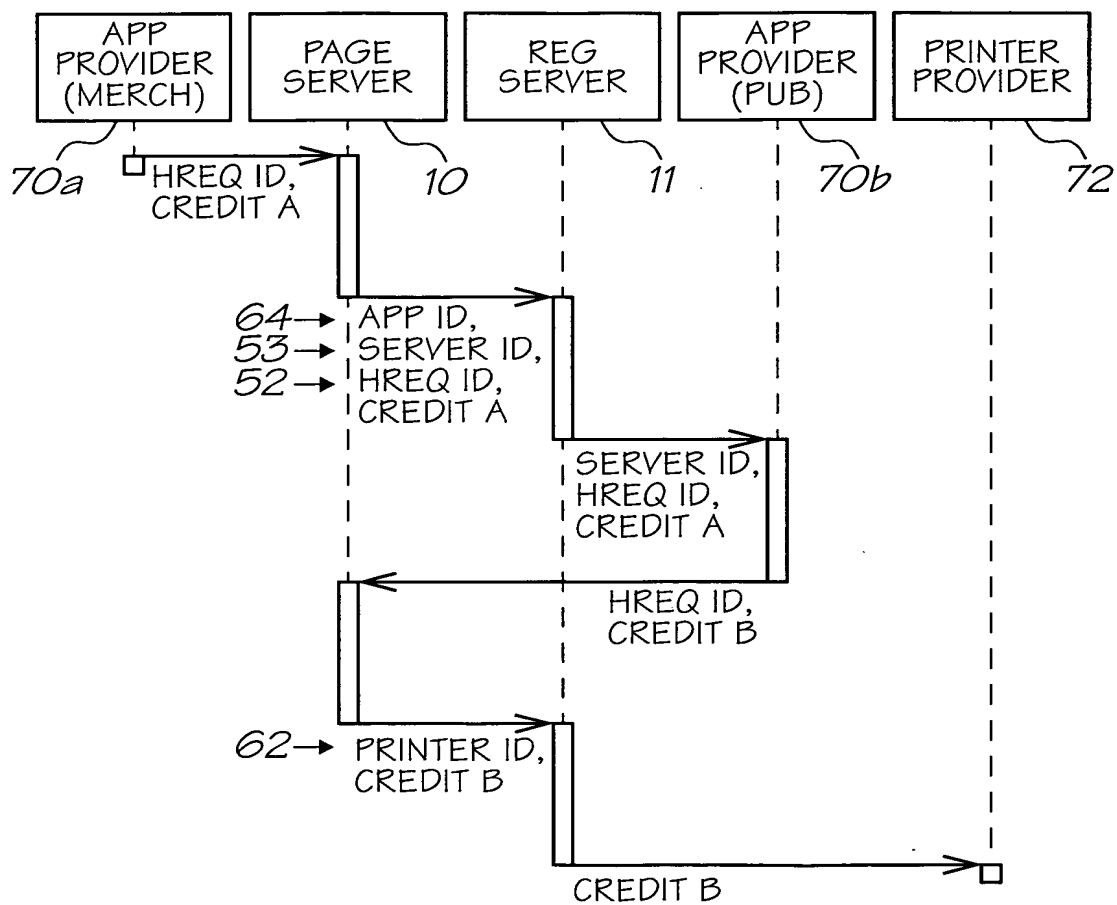


FIG. 47



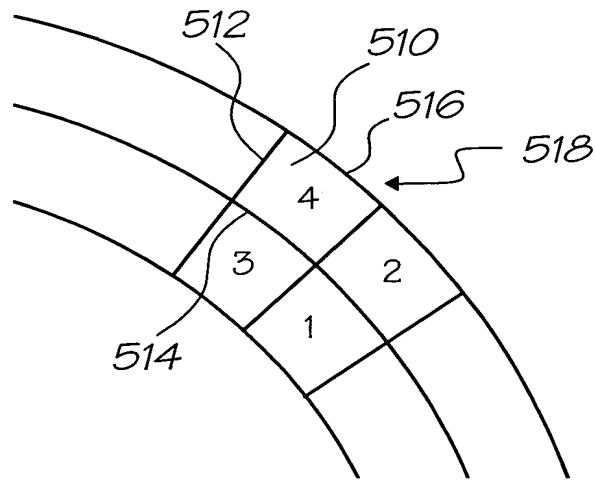


FIG. 48

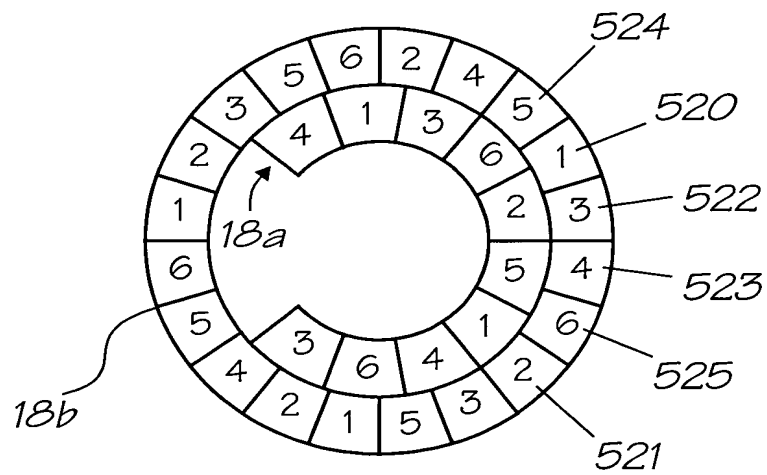


FIG. 49

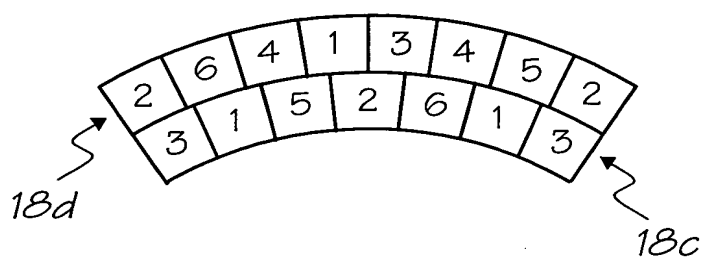


FIG. 50

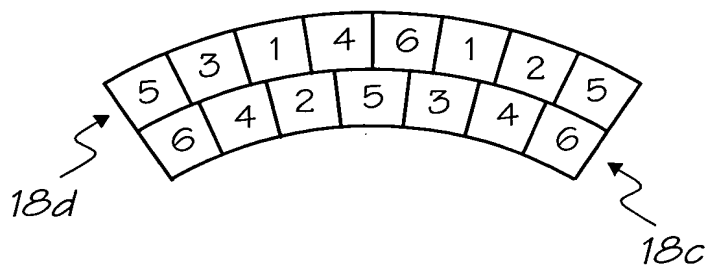


FIG. 51



FIG. 52

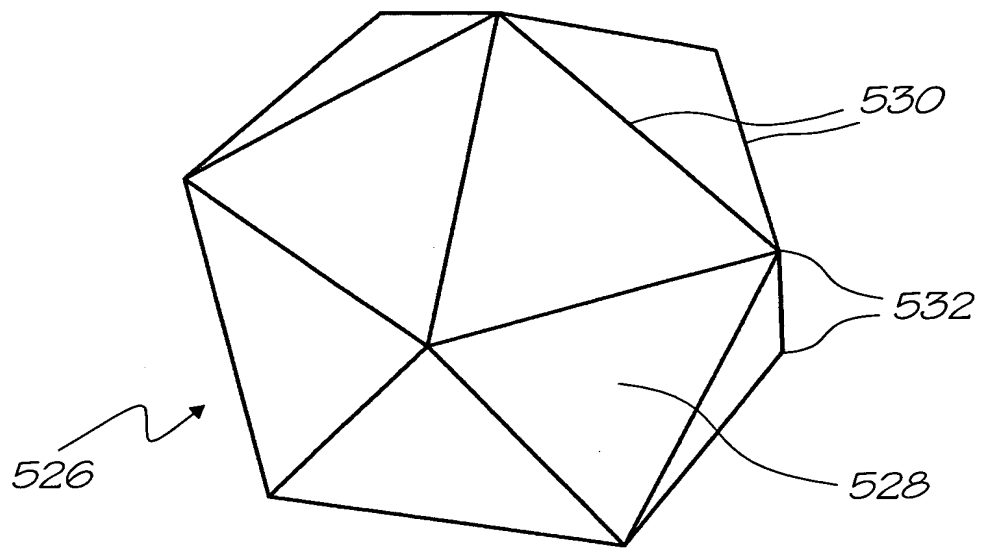


FIG. 53

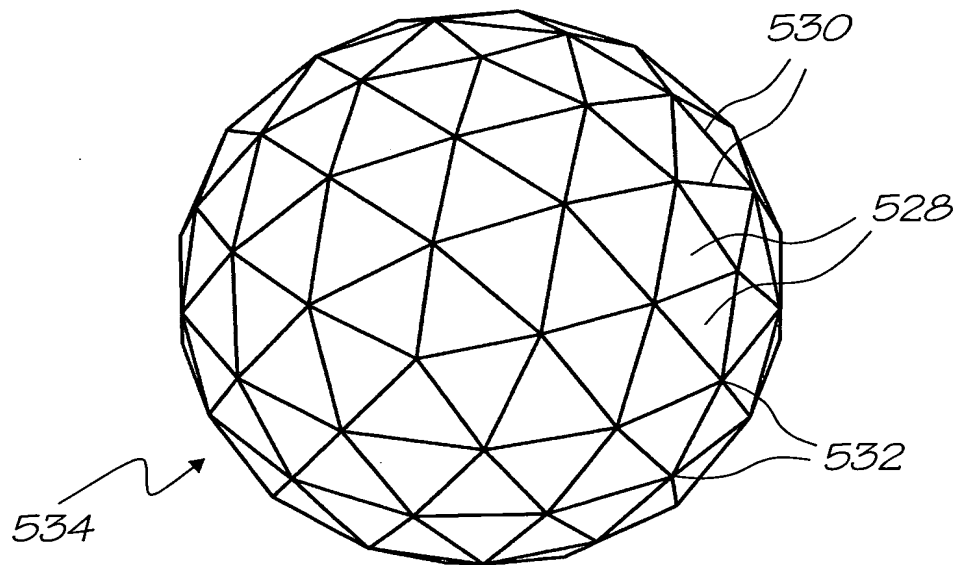


FIG. 54

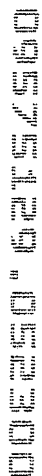
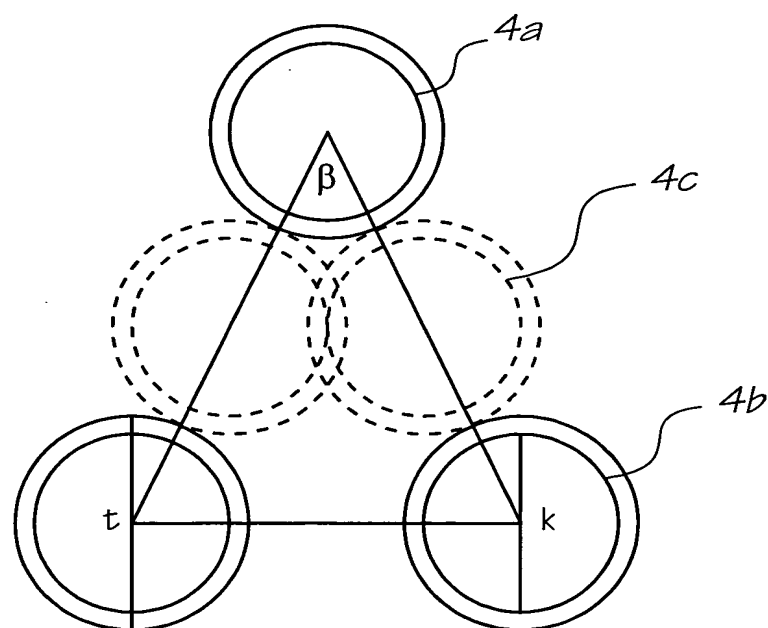


FIG. 56



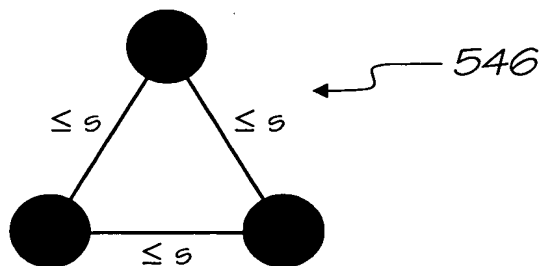


FIG. 57

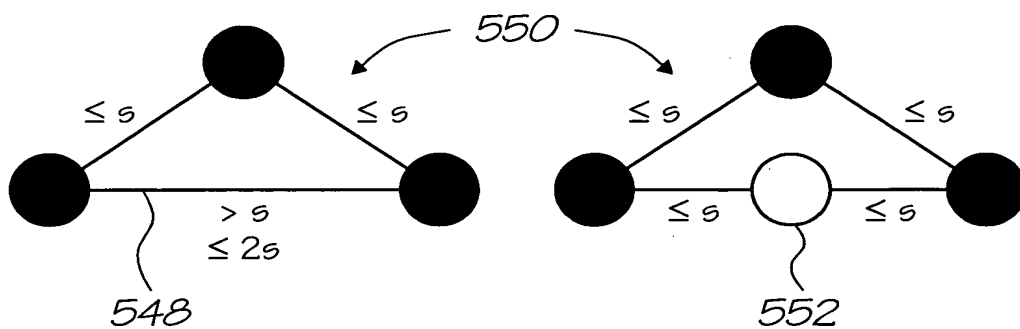
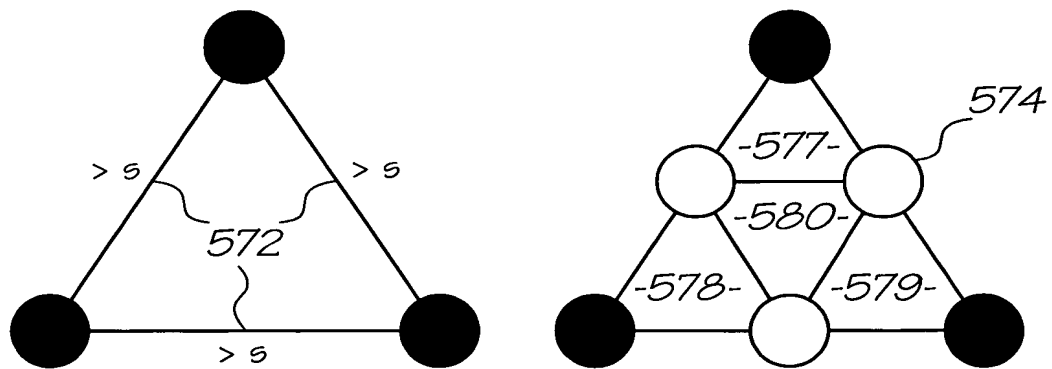


FIG. 58



FIG. 60



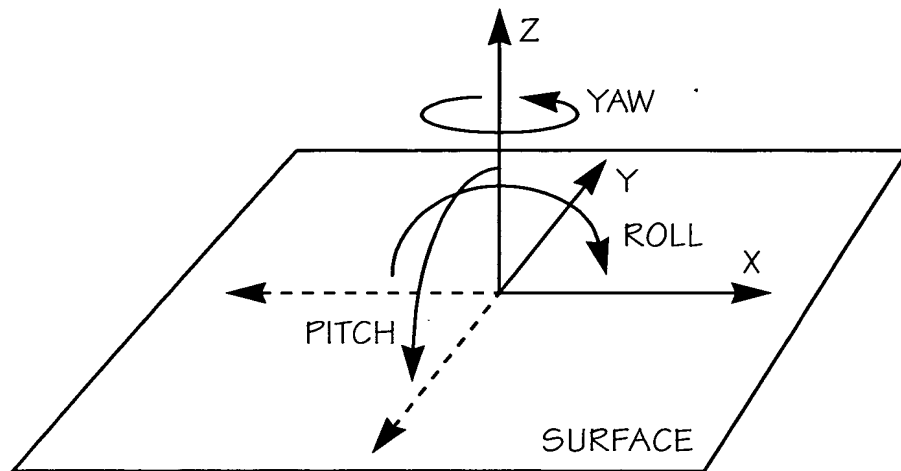


FIG. 61



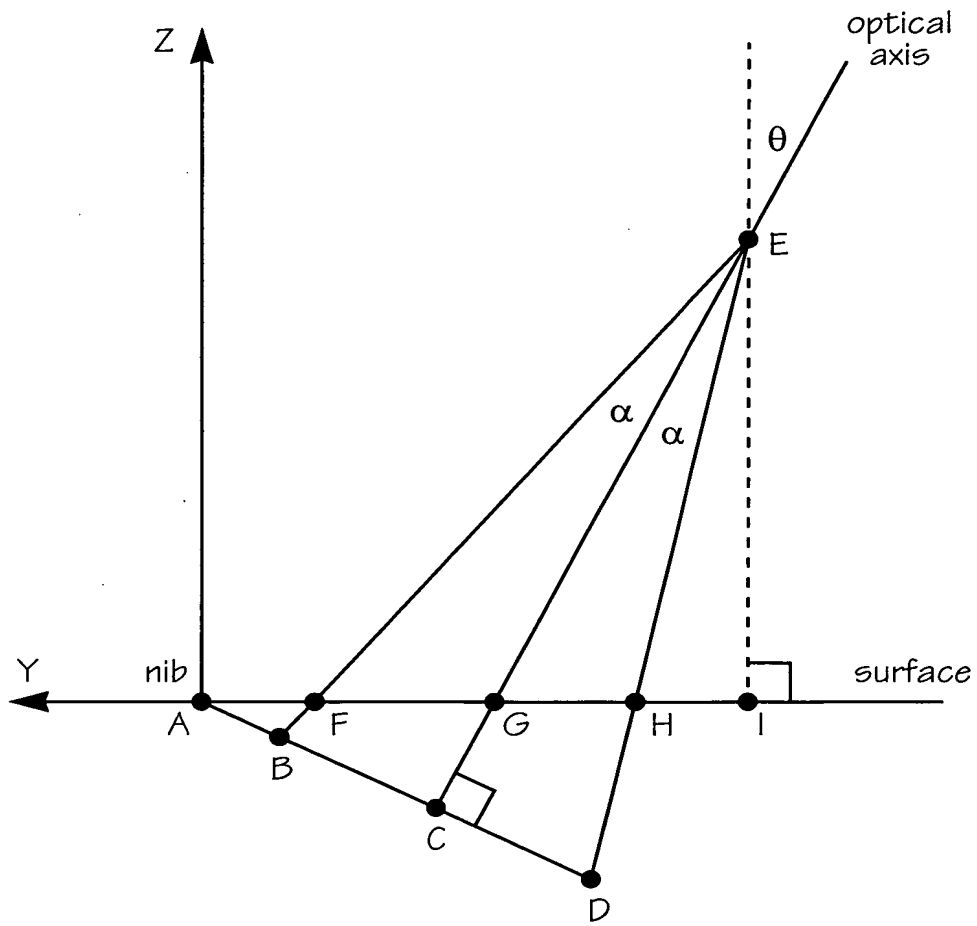


FIG. 62

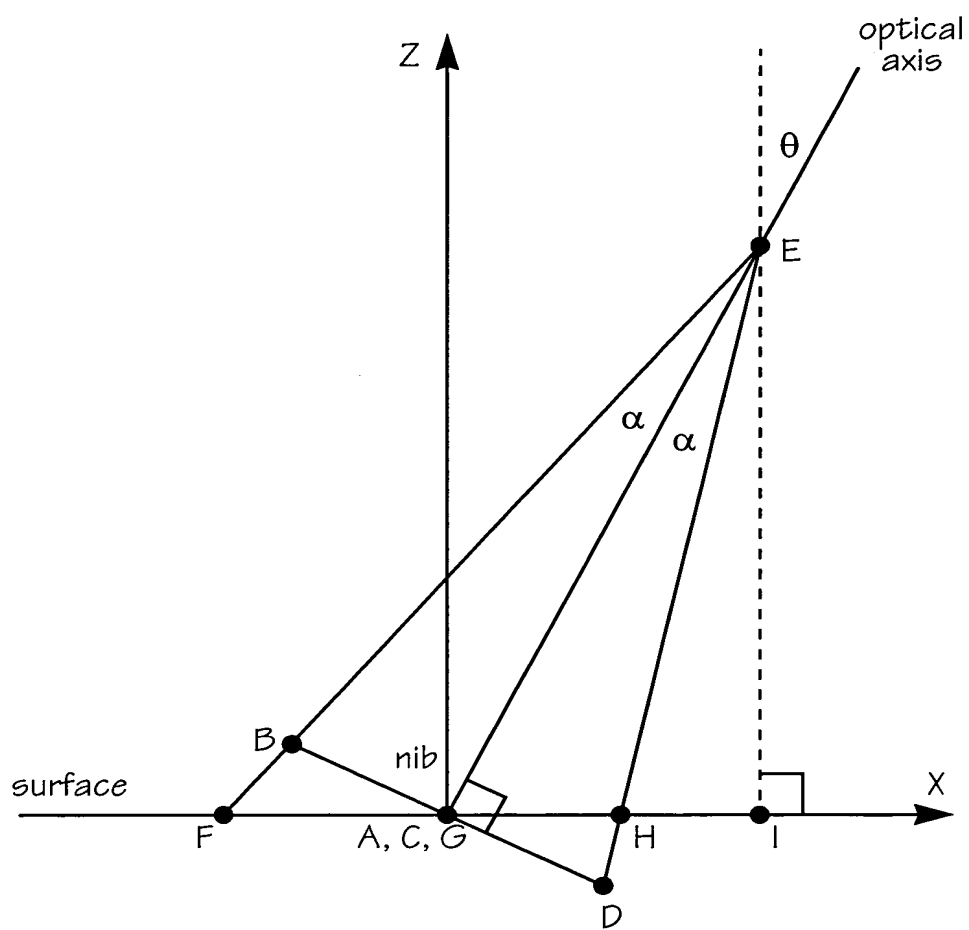


FIG. 63

FIG. 64

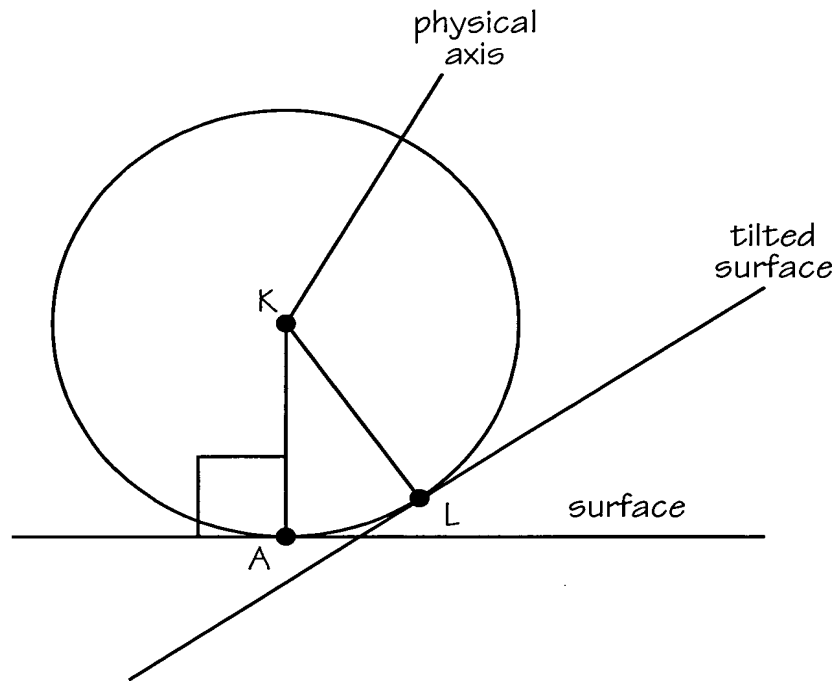


FIG. 65

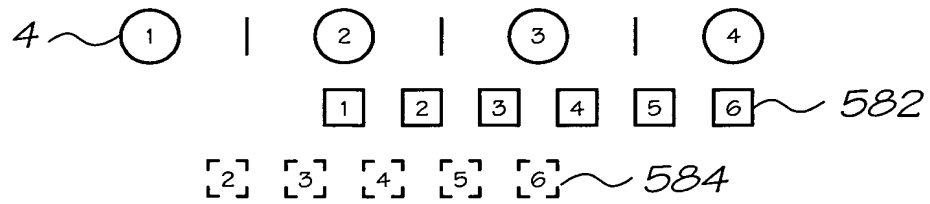


FIG. 66

EQ NUMBER	EQUATION
1	$m = k\left(\frac{2}{\sqrt{3}} + 1\right)$
2	$m = \frac{2s}{\sqrt{3}} + k$
3	$u = k\left(\frac{2}{\sqrt{3}} - 1\right)$
4	$m = \frac{7k}{3}$
5	$\theta = 2\arcsin\left(\frac{2}{\sqrt{10 + 2\sqrt{5}}}\right) \cong 63.4^\circ \cong 1.11 \text{ radians}$
6	$n = 10v^2 + 2 = 10\left[\frac{\theta r}{K}\right]^2 + 2$
7	$r \leq \frac{K}{\theta} \left[ \sqrt{\frac{n-2}{10}} \right]$
8	$s \geq 2k$
9	$\beta = 2\arcsin \frac{k}{2t}$
10	$s \geq 2t$

FIG. 67

FIG. 68

FIG. 69

EQ NUMBER	EQUATION
27	$P_{sensed} = \begin{pmatrix} 0 \\ 0 \\ -d \end{pmatrix}$
28	$P_{pivot} = \begin{pmatrix} 0 \\ S \\ R - D \end{pmatrix}$
29	$\vec{V}_{pivot-sensed} = P_{pivot} - P_{sensed} = \begin{bmatrix} 0 \\ S \\ R - D + d \end{bmatrix}$
30	$\vec{N} = M \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$
31	$\vec{V}_{contact-pivot} = R \frac{\vec{N}}{ \vec{N} }$
32	$\vec{V}_{contact-sensed} = \vec{V}_{contact-pivot} - \vec{V}_{pivot-sensed}$
33	$\vec{V}_{contact-tag} = \vec{V}_{sensed-tag} + M^{-1} \vec{V}_{contact-sensed}$
34	$P_{contact} = P_{tag} + \vec{V}_{contact-tag}$

FIG. 70



FIG. 71

EQ NUM	EQUATION
42	$M_1 = T_{xy} = \begin{bmatrix} 1 & 0 & 0 & A \\ 0 & 1 & 0 & B \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$
43	$R_z = \begin{bmatrix} C & -D & 0 & 0 \\ D & C & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$
44	$M_2 = R_z M_1 = \begin{bmatrix} C & -D & 0 & AC - BD \\ D & C & 0 & AD + BC \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$

FIG. 72

EQ NUM	EQUATION			
45	$R_x = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & E & -F & 0 \\ 0 & F & E & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$			
46	$M_3 = R_x M_2 = \begin{bmatrix} C & -D & 0 & AC - BD \\ DE & CE & -F & ADE + BCE \\ DF & CF & E & ADF + BCF \\ 0 & 0 & 0 & 1 \end{bmatrix}$			
47	$R_y = \begin{bmatrix} G & 0 & H & 0 \\ 0 & 1 & 0 & 0 \\ -H & 0 & G & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$			

FIG. 73

EQ NUM	EQUATION
48	$M_4 = R_y M_3 = \begin{bmatrix} CG + DFH & CFH - DG & EH & GK + HL \\ DE & CE & -F & ADE + BCE \\ DFG - CH & DH + CFG & EG & GL - HK \\ 0 & 0 & 0 & 1 \end{bmatrix}$
49	$K = AC - BD$
50	$L = ADF + BCF$
51	$T_z = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & I \\ 0 & 0 & 0 & 1 \end{bmatrix}$

FIG. 74

EQ NUM	EQUATION				
52	$M_5 = T_z M_4 = \begin{bmatrix} CG + DFH & CFH - DG & EH & GK + HL \\ DE & CE & -F & ADE + BCE \\ DFG - CH & DH + CFG & EG & GL - HK + I \\ 0 & 0 & 0 & 1 \end{bmatrix}$				
53	$M_p = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & J & 1 \end{bmatrix}$				
54	$M_6 = M_p M_5 = \begin{bmatrix} CG + DFH & CFH - DG & EH & GK + HL \\ DE & CE & -F & ADE + BCE \\ 0 & 0 & 0 & 0 \\ J(DFG - CH) & J(DH + CFG) & EGJ & J(GL - HK + I) + 1 \end{bmatrix}$				

FIG. 75

EQ NUM	EQUATION
55	$M_s = \begin{bmatrix} S & 0 & 0 & 0 \\ 0 & S & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$
56	$M_7 = M_s M_6 = \begin{bmatrix} S(CG + DFH) & S(CFH - DG) & SEH & S(GK + HL) \\ SDE & SCE & -SF & S(ADE + BCE) \\ 0 & 0 & 0 & 0 \\ J(DFG - CH) & J(DH + CFG) & EGJ & J(GL - HK + I) + 1 \end{bmatrix}$
57	$P_1 = M_7 \begin{bmatrix} x \\ y \\ 0 \\ 1 \end{bmatrix}$

FIG. 76

EQ NUM	EQUATION
58	$P_1 = \frac{S(CG + DFH)x + S(CFH - DG)y + S(GK + HL)}{SDEx + SCEy + S(ADE + BCE)} \left[ \frac{0}{J(DFG - CH)x + J(DH + CFG)y + J(GL - HK + I) + 1} \right]$
59	$P_1 = \frac{S(CG + DFH)x + S(CFH - DG)y + S(ACG - BDG + ADFH + BCFH)}{SDEx + SCEy + S(ADE + BCE)} \left[ \frac{0}{J(DFG - CH)x + J(DH + CFG)y + J(BDH - ACH + ADFG + BCFG + I) + 1} \right]$

FIG. 77

FIG. 78

FIG. 78



FIG. 79

FIG. 80

FIG. 81

FIG. 82

FIG. 83

FIG. 84

FIG. 85





FIG. 87